

A STUDY OF CHOREA.

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CHOREA .

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SYNONYMS.

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Chorea has been recognised by a variety of names, some of the most common being derived from some saint who enjoyed a popular reputation of power to cure the disease. For example it has been called St. Vitus's dance, St. John's dance, St. Guy's dance, St. Modestus's dance, and St. Anthony's dance. Besides these names it has been termed ballismus, paralysis vacillans, epilepsia saltatoria, orchestromania, scelotrybe, melancholia saltans, Sydenham's chorea, and minor chorea.

DEFINITION.

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Chorea is a spasmodic neurosis of childhood, rarely of adults and the aged, characterised by constant involuntary and irregular jerkings and twitchings of muscles or groups of muscles, which, in the majority of cases, cease during sleep, and are accompanied by a variable amount of psychical disturbance, and frequently associated with arthretis and endocarditis.

Though ordinary chorea, the chorea of Sydenham and of Bouteille, is most frequently described as a neurosis, there are many who regard it as a manifestation of a general condition, especially of acute articular

rheumatism, and notably Roger who insists upon its rheumatismal character. Osler(On Chorea, Philadelphia, 1894)remarks that the clinical characters of the severe cases and the frequent cardiac and articular complications have suggested to certain recent writers that it may be due to a specific poison. Some interpret chorea as a reflex phenomenon, others as a symptom complex which resembles hysteria in its etiology and in its manifestations, while Bouchut advocates the anaemic theory.

HISTORY.

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Almost all the names that have been popularly applied to this disease relate to a dancing movement. This arises from the fact that the first notice of the affection dates back to the fourteenth century, when a kind of religious mania appeared in Southern Europe in the form of an epidemic. It was characterised by excessive dancing and gesticulatory movements, and effected large numbers of people at a time. In 1375 an epidemic which arose was spoken of as St. John's dance, and in 1418, in another outbreak of the disorder which arose at Strasburg, by the order of the authorities those suffering were conducted in troops to the chapel of St. Vitus in Zabern, and there masses were said and other religious exercises performed for its cure. We are informed that St Vitus removed from Sicily when a boy, at the time of

Diocletian's persecution of the Christians in the year 303, and suffered martyrdom in Florence in company with Crescentia and his tutor Modestus (Hecker's Epidemics of the Middle Ages, Sydenham Society's Transactions). As a pandemic disease the dancing mania appears to have died out in the fifteenth century, but traces of it remained in the Rhine districts for centuries afterwards. These epidemics were quite different from what we now call chorea, and the individuals suffering were clearly affected by a psychical disorder of an hysterical form. In time, however, the name has come to be applied to a systematic disease characterised by spasmodic movements of the limbs and other parts of the body. It was, moreover, placed upon a firm nosological footing by the descriptions of Sydenham (*Shedula monitor.de novae febris ingressu, Op.Gener., 1736, I, 360, and Processus integri in morbis curandis, Op.I, 506*), and the term Sydenham's chorea is sometimes applied as a matter of justice to remember his name in connection with this important neurosis.

ETIOLOGY.

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PREDISPOSING CAUSES.

Age.

The vast majority of cases of chorea develop between five and sixteen years of age. Séc in an examination of 531 cases found 453 between the ages of six &

fifteen years, his observations being extended over twenty-two years. Of these there were 28 under six years of age, 218 from six to ten, 235 from ten to fifteen. A careful tabulation of the cases of which the beginning was known (191 in all) gave the following figures. The disease began :

| | |
|--------------------------------|------------|
| At less than 6 years | .11 times. |
| From 6 to 11 years | 94 " . |
| " 11 to 15 " | 57 " . |
| " 15 to 21 " | 17 " . |
| " 21 to 60 " | 12 " . |

Steiner's statistics agree with the above. Among his 52 patients 4 were less than six years old, 46 between six and eleven, and 6 between eleven and fourteen. In Guy's Hospital, Pye-Smith found:

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| 2 - 5 years old, 5 patients. | .2 males, 3 females. |
| 6 - 10 " " , 62 " | .15 " , 47 " . |
| 11 - 15 " " , 44 " | .17 " , 27 " . |
| 16 - 20 " " , 19 " | .3 " , 16 " . |
| 21 - 26 " " , 5 " | .0 " , 5 " . |
| 38 " " , 1 " | .1 " , 0 " . |

The disease is very rare in the middle and later periods of life, but distinct cases have been observed in the forties and fifties by Andral, Reeves, and Frank; in the sixties and seventies by Jeffries, Bouteille, Powel and Maton; and in the eighties by Sinkler (Jour. of Nervous and Mental Diseases, July, 1881). Stephen Mackenzie

cites the statistics of 439 cases tabulated for the British Medical Association Collective Investigation Committee (Brit.Med.Jour.,Feb.,1887). Of these 439 cases, 34 per cent. occurred between the ages of five & ten years, 43 per cent.between ten and fifteen years, & 16 per cent between fifteen and twenty years. The largest number of attacks occur in the thirteenth year of life. But some cases occur even much earlier than these tables would indicate. Thus, the disease has been seen to arise in children under one year of age, & between two and three years of age. Fox describes a case of congenital chorea. The child, a male, was born six weeks prematurely, and from the first hour of his life he suffered from violent choreic movements. In his third year he is said to have had epileptic attacks, but they did not occur either before or after that time. In his thirteenth year, when observed by Fox, the power of speaking and walking was defective, but intelligence was normally developed. Richter also mentions congenital chorea in two girls, whose mothers had suffered a severe fright when advanced in pregnancy. The children from their birth had clonic spasms which ceased during sleep, and at a later period almost wholly disappeared. The reported congenital cases are, however, usually mistaken instances of organic cerebral disease.

SEX.

Sex exerts a considerable influence upon the

disease. Of Sée's 531 patients, 393 were females, and 138 males. Among Ruz's patients in the children's hospital at Paris, the proportion of females to males was 138:51; with Hughes, 73:27; with Steiner 40:12; with Pye-Smith, 106:42. In 2u adult cases, between the ages of twenty and seventy, Hasse found nearly the same proportion, viz., 19:8. Sinkler has collected 328 cases, of which 232 were females and 96 males. Gowers (Diseases of the Nervous System, p. 957), who has combined the statistics of several other writers with his own, found that of 1000 cases only 365 were boys. Girls are affected more than twice as frequently as boys, and the disproportion becomes even greater after puberty.

HEREDITY.

Hereditary transmission is said to occur, but it is certainly rare. But hereditary tendency to chorea, as in other diseases of the nervous system, or rather an hereditary transmission of a special susceptibility to irritation, an impressionability of the nervous system, on the one hand, and of a general weakness of the entire constitution on the other hand, is very often demonstrable. In some cases the connection seems to be remote, but in many instances it will be found that one of the parents has suffered from some form of nervous disease or has inherited a nervous diathesis. Huntingdon, of Long Island, Ohio (Med. and Surg. Reporter, April 13, 1872), has recorded some remarkable instances of

hereditary chorea. With his father and grandfather, he has observed entire families of choreic persons, in whom the disease was propagated until once a generation had been overleapt, when the hereditary disposition in that family ceased. In these cases the chorea began between the twentieth and the fortieth year of life, attacked men and women alike, and usually led to insanity, often associated with suicidal tendencies, and finally to death. Some additional cases of hereditary chorea have been recorded by Peretti (Berl.Klin.Woch., 1885, No. 52), and others by Clarence King (New York Med. Jour., 1885, vol. I). The histories of all these cases is strikingly like those of Huntington. Mrs N., one of Peretti's cases, had a mental affection with choreic movements, and there was a history of a similar condition in her parents and grandparents. Two of Mrs N.'s four children, Mrs A. and Anton N., had chorea in adult life; some of them became insane. Anton N. had ten children; of these six had chorea. In all of Peretti's cases the disease came on after the age of forty years, and persisted. In several members of the family insanity was associated with the chorea. In the families where it occurs the nervous temperament predominates. It sometimes will be found that neither of the parents of the patient has had chorea or any other nervous disease, but an uncle or aunt had in childhood suffered from the malady.

RACE.

Weir Mitchell (Lectures on Nervous Diseases) has written upon the relation between race and chorea. He states that in answer to a circular bearing on this question, sent out by the Smithsonian Institution, he has received a large number of letters from physicians in the south of the United States and the West Indies. The general testimony was that chorea is rare among negroes; and the investigations of other observers have given similar results. Thus, Sinkler says he has only once seen a negro attacked; Osler has never observed the disease in a pure-bred negro child, and only four or five times in mulattos, out of 554 cases.

CLIMATE.

Climate has been regarded by many as having an important influence upon the production of chorea. It was thought to be less frequent in warm than in cold regions; but Hirsch denies this, and Weir Mitchell (loc. cit.) states that it does not appear to exist in one country more than another.

SEASON.

While chorea does not seem to be influenced by climate,- either as regards its development or the causation of an individual attack,- season, according to Weir Mitchell largely affects its occurrence. From a large statistical collection he shows that the majority of attacks occur in the spring.

This agrees with Wicke who found that among 35 relapses, 13 were in the spring, 12 in winter, 9 in autumn, and 1 in winter. Morris Lewis(The Polyclinic, Jan.,1887)found that the fewest attacks occurred in October (4.1 per cent.) and the greatest number in March (15.3 per cent.). On the contrary, Hammond(Amer. Jour.Med.Sci.,July,1876)found 54 attacks in the six months from October to March, and but 28 in the remainder of the year. Gerhard in a study of 80 cases found that of 68 attacks, 39 occurred in spring, 10 in summer, 7 in autumn, and 12 in winter. In Mitchell's cases a study was made of 170 attacks. In the spring and summer months there were 115 attacks against 55 in the winter and autumn months. This observer does not find that rain or dampness has any notable effect in causing the disease, but that probably a great influence.

EXCITING CAUSES.

Psychical Disturbances.

In predisposed persons especially, psychical disturbances, whether acting acutely in the form of fright or dread, or bringing to bear the slow depressing influences of sorrow and fear, of pain or discontent, are without doubt powerful agents in causing an attack of this disease. Recurrent attacks as well as the primary one may be due to this cause; as a rule, a first attack follows either immediately or within a few days after

the fright, no matter of what nature the latter may be. In children who have had chorea trivial occurrences are liable to bring on an attack, such as, for example, slight overstrain at school, the unexpected report of a pistol, a severe thunder-storm, or a severe scolding by a parent.

IMITATION.

A number of facts have been reported from reliable quarters which would seem to establish the possibility of a propagation of chorea by imitation, or what may be termed psychical contagion, among the children of the neighbourhood who are predisposed through hysteria, a neurotic temperament, or education, as in the brothers and sisters of a patient, or the children of a boarding school. Besides the older observations of Mullin(Edin. Med. and Surg.Jour.,V, I, 1805), Crampton(Trans.of the College of Physicians in Ireland,V,1824,p.110), Eckstein(Horn's Arch.j.med.Erfahrung,Bd.III,S.301,1805), & Unwins(Edin.Med.and Surg.Jour.,V,1812,p.405) the more modern ones of Brichetan and Leube may here be mentioned. Leube saw two girls, of the ages of sixteen and seventeen, hysterically predisposed, who acquired chorea in consequence of intercourse with another girl,aged twelve, who had the disease; but the malady was of short duration yielding to the usual remedies. Brichetan's observation is still more striking. Into the Hôpital Necker, in a ward where there were girls who were

hysterical or who had formerly been choreatic, a girl with chorea was admitted, and within six days eight other patients in the same ward were taken with chorea. The further spread of the disease was arrested by isolating the chorea patients. Some of the attacks lasted for months, and the symptoms were of variable intensity.

INJURY.

Chorea has been said to be induced by blows, falls, surgical lesions, tooth extraction, etc. Traumatism can not, however, be dissociated from mental shock, which in such cases is really the inciting cause.

REFLEX IRRITATION.

Chorea may be brought on by reflex irritation, such as would be produced by a nerve injury, intestinal parasites, digestive disturbances, dentition, and the like. Some authors, however, dispute their influence.

ERRORS OF REFRACTION.

Stevens and others insist upon the casual influence of anomalies of refraction. De Schweinitz found hypermetropia, or hypermetropic astigmatism, in about 77 per cent. of the chorea patients (children) he examined.

PREGNANCY.

The effect of pregnancy in producing this disease is suggested by the term chorea gravidum applied to a common disorder. Barnes (Obstet. Trans., vol. X, p. 147) has collected 58 cases, and Bodo Wenzel (Schmidt's Jahr., Bd CLXII, S. 199 ff., 1874) has added 8 more, making 66 in all.

Of 51 of these patients, 31 were primiperal, and in the majority of cases the ages were between twenty and twenty three years. The affection usually appears in the first half of pregnancy. It may cease before the eighth month or may continue to the end of gestation. Sometimes it persists after delivery. It does not necessarily occur in patients who have had the disease in childhood, but from the above cases it would seem that an attack in one pregnancy would tend to its recurrence in another. Of 66 cases, 14 had had chorea in previous pregnancies. Sometimes the chorea appears only at the time of labour; it has been known to follow an abortion. The immediate cause of chorea in pregnancy, when a cause can be found is most often fright or rheumatism, the former being borne out by Sir Samuel Wilks's observation that a large proportion of the cases occur in the unmarried. Of the 66 cases of Barnes and Wenzel, fright is named as a cause of 7, and in 7 more the attack was preceded by rheumatism and endocarditis.

Apart from pregnancy a recurrence of chorea may be produced by marriage alone, with its attendant excitements.

RHEUMATISM.

From the beginning of last century the relation of chorea to rheumatism has been observed, and observations in various parts of the world would seem to establish the fact of articular rheumatism and its card-

iac complications being an important source of chorea. The first statistics bearing upon this question originated by Hughes (Guy's Hosp.Rep.,1846), and include 108 cases of chorea, of which 14 were complicated with rheumatism and heart disease. Ten years later, the same author, in connection with E.Burton Brown (Guy's Hosp.Rep.,1856) published a second report, embracing 209 cases. Among 104, in which it was possible to make careful examination as to the history and the bodily condition as regards rheumatism and affections of the heart, there were but 15 in which rheumatic accidents had not preceded the attack, and a cardiac murmur could not be demonstrated. According to Kirkes (Med.Times & Gaz.,1863) almost all cases of chorea are caused by rheumatism. Sée (Mém.de l'Acad.,XV,1850) and Roger (Arch.gén.de Méd.,1886,XII) are the most zealous upholders of the casual relation of chorea and rheumatic affections in the widest sense. The former found among 128 chorea patients 61 who suffered at the same time with articular inflammations and pains in the joints. This coincidence seems the more remarkable as rheumatism is somewhat rare in childhood. See gives the following figures to show this: Among 11,500 patients received in the course of four years in the children's hospital there were only 48 cases of chorea without rheumatism, and 61 of rheumatism with chorea. Roger finds the coexistence of the two so frequent, that he

is inclined to regard it as the expression of a pathological law, and to regard both as one and the same affection under two forms. According to him, spontaneous acute rheumatism is far more common in childhood than is usually supposed; that is, from the fifth year onwards; before the fifth year it is certainly rare. As a sequel of scarlatina, called out by exposure to cold, rheumatism of the joints is common, is usually confined to the neck and arm, is of slight severity, lasts but a short time, and is more rarely complicated with affections of the heart, etc. The spontaneous articular rheumatism of children is oftener subacute than acute, and attacks only a small number of joints; but the frequency of complications with endocarditis and pericarditis is none the less great, and it is the lighter cases rather than the severe that are complicated with chorea, which prefers the period of the decline of the disease for its own attack. According to Roger, children who have passed through rheumatism are predisposed to chorea by that circumstance, and vice versa, choreic children are in danger of being attacked by rheumatism sooner or later; the tendency to relapse is the same in both diseases.

On the other hand, Steiner (Prager Viertl., 1868, Bd III, S. 51) made quite opposite observations in Prague. He saw among 252 cases of chorea only 4 which originated during the course of acute articular rheumatism. This

statement, however, does not prove the absence of a relation between chorea and rheumatism, for Steiner does not say what proportion of cases occurred after an attack of rheumatism which had taken place some time previous. Hammond (Diseases of the Nervous System, p. 715) believes that the influence of rheumatism upon chorea is not greater than that of a depressing agent to the organism. Sturges (Lancet, Sept. 20, 1884) says that in two years 219 cases of chorea were treated at the Hospital for Sick Children, Ormond Street, London; 20 per cent. of them were connected with rheumatism; but he does not believe in the rheumatic origin of the disease, because 15 per cent. of all children have rheumatism. Copland, Seahouse, Forgues, Bright, Babington, Hughes, Monkton, Hillier, Romberg, and Trousseau believe in a casual relationship between chorea and rheumatism. This occurred in about one-fourth of the cases reported by the British Medical Association Collective Investigation Committee, and Gowers, Eichhorst and Strümpell think the relationship between the two diseases an occasional one; Brieger (Berl. Klin. Woch., 1886, No. 10) insists on the existence of an alternation between these conditions. Fogge found endocardial changes in 17 out of 18 chorea autopsies at Guy's Hospital. Osler found a rheumatic association in 21 per cent. and 18.24 per cent. in two series; Tounsend, 21; and Crandall, 54. Herringham (Lancet, Jan. 12, 1889), Cheadle (Ibid., May 4,

1889) Mackenzie, and Bouchard have convinced themselves that an intimate relation exists between chorea and rheumatism. Hirt (Pathol.und Therap.der Nervenkr.,p. 397) thinks that there is a common toxic agent, which if it affect the cortex will produce choreic movements, if it affect the joints chiefly will give rise to acute rheumatism. This is too sweeping an assertion. That toxic agents may occasionally produce rheumatism and chorea is, no doubt, possible, but the large number of cases due to fright cannot be accounted for in this way.

INFECTIOUS DISEASES.

These sometimes precede chorea, particularly scarlet fever, but this relationship is mainly one of coincidence. Carslaw noted chorea in only 3 of his collection of 533 cases of scarlet fever. In not a single instance did Osler find that scarlet fever had preceded chorea in his 141 cases of the former disease out of 554 of the latter. On the other hand, Ross thinks that scarlet fever very often precedes chorea and explains the association by the frequency with which rheumatism follows the former. Chorea has also followed other diseases of this class, such as enteric fever, diphtheria, small-pox, measles, pneumonia, and cholera. Sturges has seen chorea preceded by whooping-cough. The former has also been observed in association with pyaemia, gonorrhoea, and secondary syphilis. Stratton thinks the microbes may produce the malady by absorption

from the naso-pharyngeal erosions in children. Malaria has also been pointed out as influencing the production and course of chorea. Kinnecut has reported some cases in which the movements were aggravated with a certain periodicity; but the disease is not more frequent in malarial districts than elsewhere. The infectious diseases may modify the chorea. If occurring in its early stage they intensify it, but if it be on the wane they may hasten its retrogression. This favourable influence is probably due to the enforced rest - the most important element in the treatment of chorea.

INTOXICATIONS.

That poisons may produce chorea would seem established by Demme's observation with reference to iodoform. While treating a caries of the cervical vertebrae through a fistula with iodoform choreic movements appeared, ceased on suspension of the drug and returned on its resumption.

DEBILITATING INFLUENCES.

Trousseau, Bouchut, Rachford, and others insist impoverished states of the blood as etiologic of chorea. This is denied by Osler. Anaemia and malnutrition sometimes do precede chorea, but more often follow and are symptomatic manifestations.

HYSTERIA.

An association between hysteria and chorea has frequently been observed. Duchateau has collected 34

cases of this kind.

EPILEPSY.

Gowers mentions a few cases in which epilepsy dated from chorea, and others the commencement of the latter after the cessation of the former.

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P A T H O L O G Y

AND

* M O R B I D A N A T O M Y .

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The pathology of Chorea is very intricate as it is a symptom complex which manifests itself under very different conditions. Many theories have been advanced regarding the nature of the disease. Anything and everything, from a blood-diathesis to a tumour in any part of the brain, has at one time or other been held to be the cause of chorea.

Few post mortems have been made as the disease is so seldom fatal, and in the extraordinarily severe cases can scarcely be regarded as representing the anatomy of the disease. Even in such cases there are no uniform or characteristic changes. In the earlier autopsies, before the microscope was extensively used, but little of value was recorded. Sée, who collected 84 cases in which post mortem examinations were made, reported that in 16 no changes were found in the nervous

system. In the 32 there were lesions in the brain and nervous centres, usually softening and tuberculosis, and in the remainder inflammatory changes in the serous membranes. In 29 there were evidences of heart disease. Sée considered that but few cases of death in chorea were caused by inflammatory diseases of the heart, but that the majority should be referred to nervous excitement and anaemia. Ogle (Brit. and Foreign Med.-Chir. Rev. Jan., 1868), in a report of 96 cases of chorea mentions 16 which were fatal. Post-mortem examinations were made in all of these. Cardiac lesions were found in 13. In ten of these deposits were found upon the valves, and in 3 there was some change in the pericardium. He speaks vaguely of having noted congestion of the nervous centres six times, and softening of the cord once. Pye-Smith (Guy's Hosp. Rep., 1876) reports the finding of cardiac lesions in 11 autopsies. In every case old or recent deposits were observed upon the valves. In two instances the heart was hypertrophied, and in one there was pericarditis. Changes in the nervous system was less often found by this author. In 1 case there was hyperaemia of the cord, and in 3 cerebral anaemia. Dickenson found in 22 fatal cases of chorea 17 in which the heart was diseased. In every instance there were recent vegetations on the mitral valve, and often also elsewhere. Hutchinson found incompetence of the aortic valves in one fatal case, the leaflets being swollen &

softened, and the aorta was atheromatous above the sinus of Valsalva. Steiner reported in 1868 the results of post-mortem examinations in 3 fatal cases of chorea. In one case he found cerebro-spinal anaemia, serous effusion into the spinal canal, and proliferation of the connective tissue in the upper part of the cord; and in another Elischer (Virchow's Arch., Bd. LXI, 1874, p. 485, & Bd. LXIII, 1875, p. 104), who reports a fatal case in a parturient woman who had an attack of chorea in her eighth year, two in her sixteenth year, and another in her previous pregnancy, found at the autopsy hyperaemia and oedema of the brain and gray substance of the cord. Microscopically, the brain showed fatty, amyloid, and pigmentary changes in the nerve-elements and vessels of the large central ganglia, small secondary extravasations of blood in the connective tissue, and numerous embolic in the smallest vessels, especially in the cortex. In the spinal cord there was seen abundant proliferation of nuclei in the adventitia of the vessels. In the central canal serum was found, and the surrounding connective tissue was harder than under normal conditions.

Dickenson (Med.-Chir. Trans., vol. XLI, 1876, p. 1) describes the autopsies of 7 fatal cases in which he made microscopical examination of the brain and spinal cord. In all of them there were found hyperaemia of both these structures, in many instances haemorrhages into

the substance of the nervous tissues, dilatation of the smaller vessels, and in chronic cases sclerotic changes in the course of the vessels. The first visible change, he believed, was injection or distension of the arteries, succeeded by extrusion of their contents and irritation and injury of the surrounding tissue. The changes seemed to affect both brain and cord in all cases. The parts of the brain most commonly affected lay between the base and floor of the lateral ventricles in the track of the middle cerebral arteries, the perforated spaces, the corpora striata, and the beginning of the Sylvian fissures. No part of the cord was exempt, but perhaps the cervical and dorsal regions were usually more affected than the lumbar. With regard to the columns of the cord, all these, whether white or gray, shared in the vascular destruction; this condition, however, was usually most marked in the vessels belonging to or in connection with the lateral part of the gray matter about the root of each posterior horn. "And it is to be observed that this was also the chosen situation of the more definite and special changes, whether haemorrhagic(as in two instances), sclerose, or exudatory. Speaking generally the chosen seats of the choreic changes are the parts of the brain which lie between the beginning of the middle cerebral arteries and the corpora striata - the parta perforata; and in the cord the central portion of each lateral mass of gray matter

comprising the root of each posterior horn".

From a study of 79 autopsies Raymond draws the following conclusions:- (1) In persons who succumb in the course of a simple chorea lesions of the brain and of the heart are most common; (2) Lesions confined to the encephalon are rare; most frequently the cord and heart are affected at the same time; (3) Hyperaemia is especially frequent, then follows softening, then chronic encephalitis; (4) The mode of the softening is often readily established; nearly always deposits are present on the valves, several times even emboli have been discovered in the cephalic vessels; (5) With the exception of this last lesion hardly anything has been described that could be compared to the findings in symptomatic choreiform states. The most probable hypothesis, however, relative to the localisation of the lesion in ordinary chorea is to place it in the course of the pyramidal bundle, whose irritation may produce various movements of a spasmodic character.

Several observers, and among them Hughlings Jackson, have advocated the embolic theory of chorea. It is undoubtedly an attractive view, especially when we consider the large proportion of cases in which there is valvular disease of the heart. Dickinson, however, does not consider this hypothesis tenable, for in none of his cases did he find evidences of embolism. The explanation is likewise unsatisfactory in that large num-

ber of cases in which there is no endocarditis, and, furthermore, Gowers and others have failed to reveal emboli in the brain of persons who have died of chorea. Bearing upon this question may be cited the experiment of Money, (Lancet, 1885) who by injections of a fluid into the carotids of animals produced movements closely resembling those of chorea, and this condition was associated with embolism of the brain and spinal cord.

Elsewhere we have stated that rheumatism may account for a certain number of the lesions; but rheumatism is not always a factor, being sometimes absent. Duchanteau, in a statistical study of 1,600 cases, found a proportion of 28.1 per cent. of rheumatic chorea and 71.9 per cent. of chorea independent of rheumatism.

Wood (Phila. Med. News, May 30, 1885) has performed autopsies upon a number of dogs who had chorea, and believes that, owing to emotional disturbance, sometimes stopping of various vessels of the brain, or sometimes the presence of organic disease, there is an altered condition of the ganglionic cells throughout the nerve-centres. If the cause is removed and the altered condition of the nerve-cells goes only so far, it remains a functional disease only, but an organic disease of the nervous system when the cells undergo alteration. In two dogs which were choreic the movements continued after section of the cord. This shows that in dogs, at any rate, the movements originate in the cord. In four

instances of canine chorea in which Wood made post mortem examinations there were found in the cords of three, mild grades of infiltration of leucocytes in the gray matter. In the fourth, in which the dog had died of the disease, the ganglion-cells were degenerated, and in some places had disappeared. He concludes, therefore, that choreic movements may depend upon a diseased condition of the motor cells of the cord. Notwithstanding that lesions of the spinal ganglion cells have been found in several cases of human chorea this is not regarded as a constant histological change in chorea. The disease is too transient in many cases, and presents to many variations and anomalies, for the diseased condition to be invariably located in the spinal cord.

The theory of the infectious nature of chorea is far from proved, in spite of Strumpell's warm advocacy of this hypothesis. Leredde has shown that an infectious endocarditis, independent of rheumatism, may be observed in choreic patients. In 1891 Pianese (La Riforma Med., July 14, 1891) was able to isolate a rod-shaped bacillus from the brain and spinal cord of a fatal case of chorea, and to cultivate it. Injected into animals it produced apathy, then tremor, then convulsive movements, and, finally, death. The bacillus was found in the brain and cord of these animals after death. So far, no one has been able to confirm this experience. Möbius, Berkley, Osler, and Dana have more

recently developed the theory of the chorea of infection, based partly on clinical, partly on anatomical observations. Triboulet does not believe in specific infection like Pianèse, but in a variable infection which he has been able to demonstrate in several cases. In connection with a case of chorea which he observed in a girl suffering from tuberculous adenitis, Massalunga states that chorea may be explained by the action of the poisons formed in the tuberculous foci upon the nervous system. Dana (Amer. Jour. Med. Sci., Jan., 1894) found in a fatal case a diplococcus in the meninges, but as subacute leptomeningitis was present, it was possibly or probably the specific micrococcus of that disease. Meyer describes his finding of staphylococci and streptococci in the viscera and blood, and believes this suggests a relationship of chorea to rheumatism. Westphal, Wasserman, and Malkoff (Berl. Klin. Woch., No. 29, 1899) succeeded in producing arthritis in animals by injecting into them a micrococcus which they isolated from the blood, brain, and cardiac vegetations of a fatal case of chorea.

A variety of micro-organisms have been found.

Reichardt observed the staphylococcus aureus and the streptococcus, and Guizetti the staphylococcus aureus and pyogenes. Preoprajensky (La Sem. Méd., Dec. 10, 1902) reports having found streptococci in the blood of two of his chorea patients, both of whom rapidly improved

under antistreptococcus serum. Benton and Walker(Brit. Med.Jour.,Jan.31,1903)believe they have isolated a specific streptococcus in chorea and acute rheumatism, which differs from that of septicaemic conditions.

Intense hyperaemia, peri-arterial exudations, punctiform haemorrhages, foci of softening, and emboli here and there have been observed in the brain and spinal cord, but more especially in the basal ganglia and the deeper portions of the motor tracts. The so-called chorea corpuscles, described by Elischer and others,are equally developed in various infections, as demonstrated by Manasse, who found them in 20 fatal septic cases, and was able to produce them in dogs by intravenous injections of putrescent substances. He says they are hyaline in chemical reaction, develop in and around the arterioles and in the perivascular spaces throughout the brain and spinal cord, and furnish another argument for the infectious nature of chorea. Turner (Trans. Path.Soc.,1892,vol.XLIII) has seen swellings and opacities in the cortical pyramidal cells. One of his 5 cases had puerperal sepsis and 2 Albuminuria, both of which might account for the cellular changes. The 2 remaining cases, if identical, may be taken as showing changes of a septic or infectious nature.

Cardiac lesions are more often found in fatal cases of chorea than in any other disease. This was Osler's experience in over 90 per cent. of his 73 cases.

There was recent endocarditis in 62; with pericarditis in 19; pericarditis alone in 2 cases; chronic mitral endocarditis in 2; and fatty heart in 1. The usual finding is a row of papillary granulations at the mitral orifice.

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S Y M P T O M A T O L O G Y.

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GENERAL DESCRIPTION.

Usually an attack of chorea is preceded by more or less failure of the general health and evidences of some mental disturbance. It is quite common to be told by the parents of a child suffering from chorea that the patient had seemed unwell for some time previous to the attack; that the appetite had failed, and that the child had looked pale; that he had been irritable or excitable, and at school the teacher had complained of restlessness or inattention in the pupil. There may be a striking change in the temper, a fretful, discontented, or apathetic behaviour in children formerly cheerful and brisk, unusual changeableness of temper, sudden and causeless change from sadness to excessive mirth, or the reverse. Sometimes nothing appears wrong with the child until abnormal twitchings and movements of the limbs are observed. The characteristic muscular twitchings are most likely to form a first symptom in the very acute cases caused by fright.

Of the characteristic choreic disturbances of motion, the first indication is given by a general restlessness and fidgetiness of the body. The child may be punished at school for not keeping still or for dropping things. Soon irregular movements of groups of muscles are seen. The shoulder is shrugged or the fingers move spasmodically. At first the patient is aware of the movements and tries to control them, but before long the twitching and jerking are constant, and extend to most of the voluntary muscles of the body, and not only interfere with willed actions, but by the frequency of their spontaneous occurrence keep the body in continual unrest. In spite of his best efforts, and the powerful influence of his parents' scoldings, his playmates' ridicule and the presence of strangers, the child is unable to prevent the muscular contractions for any length of time. Often the will is not able to diminish the spontaneous twitchings, and the effort may even aggravate them.

The sudden jerk of a limb, the want of order with which the spontaneous jerkings pass from one member to another, the tireless activity of the muscles in spite of the purposeless and useless nature of the acts, the slow and careful way in which intended motions are performed, the spasmodic grimaces, alternating with periods of expressionless, almost idiotic, rest, all give a characteristic picture which can hardly be mistaken.

The extent of the movements varies in different cases. Sometimes one arm is bent or extended; sometimes the fingers are spread apart; the shoulder raised; the head jerked in one or other direction; and the features undergo contortions continually, and when at rest relapse into a condition of vacancy which makes the patient look almost idiotic: the expression of a child with chorea is so peculiar that the disease may almost be diagnosticated by this. The eyes are rolled hither and thither; the mouth is sometimes opened, sometimes closed; the jaws are separated and brought together, sometimes so violently that the teeth are broken off (in a case reported by Tuckwell that ended fatally, in a girl of ten, three of the lower incisors were broken off by the spasms of the muscles of mastication; the exposed gum was by degrees worn to shreds by the upper teeth); the tongue is protuded and drawn back suddenly, or is rolled about in the mouth. The spasms of the trunk give rise to active locomotor movements of the whole body; the patient is thrown from his chair or out of bed. The legs are affected, sometimes they are rubbed on the floor when the patient is sitting; sometimes they are suddenly drawn to the trunk, so that if the patient is walking he falls, or is turned or hurled to one side or another. Often the disorder is confined to one lateral half of the body. In time every intentional movement becomes impossible; the patient can no

longer eat without help, as he spills everything, drops his cup, and fails to reach his mouth with the fork or spoon; and he can no longer dress himself. The speech is often affected. The patient speaks in a thick or jerky manner, as if the tongue were too large for the mouth, and saliva usually flows in great quantities. Involuntary utterances are sometimes made at frequent intervals in bad cases. Except in grave cases, the sphincters are never affected.

The movements usually cease during sleep, but generally the patient is restless when asleep, and in some instances the movements continue even at this time. On wakening the twitchings return and continue as before.

There generally shows some change in the patient's mental condition. The child is irritable and peevish, cries, and laughs readily, or is sullen and morose. Sometimes he is violent to those about him, but this is rare. With these changes there is often joined failure in intellectual power, with incapacity to think, imperfection of judgement, and weakness of memory. A mild form of dementia is noted in certain cases.

Improvement in the symptoms usually takes place very gradually; during the course of the disease there may be exacerbations; and relapses may interrupt the convalescence. As a rule, no traces of the disease remain after the patients recovery.

ANALYSIS OF THE SYMPTOMS: COMPLICATIONS AND
SEQUELAE.

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MOTOR SYMPTOMS.

The characteristic involuntary muscular contractions commonly begin in one upper extremity. The hand is thrown into various positions, the fingers are flexed and extended or separated, and all of the movements occur with great rapidity. In a day or two the whole arm is affected, and then the leg of the same side is involved in the jerkings and twitchings. In many cases the facial muscles are contorted, the mouth is pursed up or wide open, and then quickly twisted into some other shape. If the patient is told to put out his tongue, it is protruded after a moment's hesitation, and then suddenly retracted, the jaws coming together with a snap. A smacking sound is made with the lips quite often, and words are uttered involuntarily. The movements may remain confined to one side of the body, constituting what is called hemichorea. This is quite common, and the right side is rather more frequently involved than the left. There is so great difference of opinion among authors that it is probable that one side is affected about as often as the other. In 1760, Ewart (De chorea St.Viti.Edin.,1760) reported several cases of unilateral chorea, most of them being left-

sided. Gerhard (Amer. Jour. Med. Sci.) found in 80 cases of chorea that 32 were unilateral; of these 20 were right and 12 were left. Sée found that, out of 154 cases in which the seat of the affection was carefully noted, the movements were confined to the left side, or were more marked there, in 97 cases. He states that in his experience the proportion between left and right hemichorea is as 37 to 27. Pye-Smith observed, among 150 cases, 33 confined to one side, of which 15 were on the right side and 18 on the left. Russell observed, among 97 cases, 29 confined to one side, and of 54 that involved both, the disease began as unilateral in 43. Hughlings Jackson states that in cases of moderate intensity the movements may certainly be unilateral so far as the limbs are concerned, but the muscles of the face and trunk are always bilaterally affected. He has noted the right side more often involved than the left. Jaccond and Sir William Gowers have, however, observed a left-side affection in the vast majority of their cases.

The acme of the disease is usually attained in two weeks, and if the case is a bad one we find by this time all of the voluntary muscles are in constant movement. The terms "insanity of muscles", "folie musculaire", applied by Bellingham and Bouillaud to the confused play of muscles is most appropriate at this period. Patients are often unable to walk or to sit up,

and sometimes they may be thrown from the bed by violent spasmodic movements of the trunk. Strange to say, patients rarely complain of fatigue, notwithstanding the violent muscular exercise. The explanation of this absence of local exhaustion is probably to be found in the excessively short duration of the individual contractions and the constant change in the seat of each set of movements.

In the great majority of cases the movements cease during sleep. Sometimes, however, occasional twitchings of muscles are seen in sleep, and in rare instances the movements are as active in sleep as when the patient is awake.

The characteristic movements occur either while the limbs are at rest or under the influence of voluntary effort. This fact has been dwelt upon by Gowers, Mitchell, and others. In some cases the movements are most marked when the patient is at rest. If a directed effort is made to use the member for some time, the choreic movements are suspended. For example, a patient may be able to carry a glass of water to the mouth without spilling a drop, while a moment before the hand may have been performing a continual dance. Frequently while the limb to which the whole attention has been directed in performing some movement is steadied, the other limbs become violently agitated. In another class of cases the movements are comparatively slight

when the patient is at rest, but when a motion is attempted the disorder of the muscles is so much increased that it is almost impossible for the act to be completed. The patient is told to pick up some small object; he throws the hand out towards it, and it is jerked away before he can grasp it. He again puts the hand forward, reaches the object, and the fingers open and shut and sprawl over the article before it is taken up. Sometimes it cannot be grasped at all. This has been called choreic ataxia, but it is only one type of the cases commonly encountered. There are some cases, as mentioned above, in which the movements may be controlled by the will for a brief period, but they will return sooner or later. In other cases it is quite impossible for the patient to check the movements at all, and one frequently sees in a case of hemichorea the sound hand used to grasp the other, so as to control the movements. I have referred to this because of Niemeyer's opinion that corporeal punishment would shorten an attack of chorea. Several varieties of choreic cases depending upon motor peculiarities have been defined by Mitchell and Rhein (Phila.Med.Jour., Jan 22, 1898): (1) Cases which show at some stage or throughout the attack, an absence of movements during rest; (2) Cases with continuous movements during rest, but increased by intentional effort; (3) Cases with severe choreic movements, entirely disappearing during muscular

acts; (4) Cases in which the movements are unaltered by muscular efforts; (5) Cases presenting several of these phases at different times.

Occasionally the spasm may be confined to a single muscle or group of muscles. When limited in this way it is generally in the head, face, or perhaps in the shoulder. These cases of localised chorea have been spoken of by Mitchell as habit chorea. They sometimes last during life and are very obstinate in resisting treatment. According to Bernt, certain positions of the body may cause the appearance or disappearance of the involuntary muscular contractions; and in support of his opinion cites two observations made by Tulpius and Thirmaier, and makes two classes - chorea sedentaria (Tulpius's case of a hysterical female who is said to have been affected with chorea only when in a sitting posture), and chorea stataria (Thirmaier's case of a man who was always brought to his feet by the spasm, although they tried to fasten him to his bed or arm-chair). But as it is highly doubtful that these cases were true chorea we may pass them over without further comment.

Paralysis to a greater or less extent may be present in chorea. It is generally one-sided, and most often involves the upper extremity. The limb affected is the one in which the movements were most violent. The arm may hang entirely powerless or it may be only

enfeebled, and feeling to the patient like a dead weight. The paralysis recovers with the chorea or early in the convalescence of the latter.

Under the name of post-paralytic chorea, Mitchell and Charcot have described a variety of chorea which is seen in patients after an attack of hemiplegia. The movements are chiefly on voluntary effort, and are those of inco-ordination. They come on from one to several months after an attack of unilateral paralysis, and are sometimes seen in cases in which almost complete recovery has taken place. Mitchell mentions a case in which the patient had two attacks of left hemiplegia, the last being fatal. After the first attack there was great gain of power to use the arm and leg, but the movements were performed awkwardly and with an irregular jerking movement. The autopsy revealed a spot of softening the size of a filbert in the left corpus striatum, which was apparently recent, and a point of red degeneration in the right crus cerebri. There was considerable atheroma in the vessels at the base of the brain.

During an attack of chorea the electrical reactions are sometimes slightly altered. Rosenthal, Benedikt, and Gowers found an increased response to the faradic and galvanic currents on the part of the muscles and nerves of the affected side. Only in cases of hemichorea could this be determined. Some have asserted

that the reaction of degeneration with qualitative changes (ACC>KCC, etc.) occurs in some instances. I am inclined to question the truth of this statement, for a large number of electrical examinations of choreic patients has never revealed a change of the normal galvanic formula. Cases reported showing the reaction of degeneration are doubtless complicated with some other disease.

The affection of speech which is so common in chorea depends not only upon a disordered action of the muscles of the tongue and larynx, but may be due to chorea of the muscle of the abdomen as well. The implication of the muscles of the abdomen is best shown by the effect produced upon the act of expiration, which especially when forcibly performed, assumes an irregular, jerking character. The effect is most marked when the patient is caused to sing, or to speak continuously as in counting. In slight cases this produces only a deficiency in the power of continuing the equal pressure of expiration required for vocalisation; the pressure soon ceases, and rather suddenly, so that the patients can bring out only a few syllables or numbers, which are interrupted by a hasty inspiration. In severe cases they can utter only one syllable or number in one expiratory effort, and between every two syllables there is a remarkable hasty inspiration; others drive out their syllables or numbers forcibly, and their

speech has something of an explosive character. As the case improves, the number of syllables which can be spoken with a single effort increases. By placing the hand upon the abdomen the explosive contractions of the abdominal muscles can be appreciated. When chorea affects the laryngeal muscles it occasions an insufficient force and duration of the tension of the vocal cords in phonation, owing to the want of co-ordination and persistence in the muscular act; the patient is unable to sustain a tone in singing for any considerable time, or to utter several words together without interruption. The singing tone is suddenly interrupted, and the last syllables of the word are cut off in the effort to make the next inspiration. In reading aloud a good deal of muscular force and of breath is expended, so that the patient is soon very tired. That the tension of the vocal cords in phonation is often insufficient is shown in certain cases by the relatively deep pitch and monotony of the voice, disappearing with convalescence and being replaced by the normal pitch and modulation of the voice. The restless action of the laryngeal muscles can sometimes be seen with the laryngoscope.

Chorea of the heart is spoken of by many authors, but it has never been satisfactorily demonstrated that there is any real disorder of cardiac rhythm in chorea. Certainly one sometimes meets with irregularities of

rhythm or palpitation of the heart, but these conditions do not necessarily depend on chorea. According to Stiebel (Klin.Beit.zur Heilwissen.Frankfort a.M.,1823, pp.43-67) the palpitations are especially prominent during the decline of the disease. Reeves (Heart Diseases in Australia, with Observations on Aneurism of the Aorta. Melbourne,1873) has described chorea of the heart as being often connected with chlorosis and general chorea, but also occurring apart from them, in which there occur nightly attacks of palpitation and dyspnosa, with free intervals; attacks which, therefore, somewhat resemble those of angina pectoris. In this description we find nothing characteristic, nothing which differs from the nervous palpitations which are so frequent in young persons, and it would, therefore, be very improper to give the name of chorea of the heart to anomalies of this sort as Reeves has done.

Valvular murmurs are often met with from the beginning of an attack. In some instances they are the result of an endocarditis, but frequently they are functional or anaemic. They are usually heard at the apex. Sometimes there is reduplication of the first sound, giving the idea of a want of synchronism in the action of the two sides of the heart; but this is probably not the result of chorea of the heart. Organic murmurs are usually heard over the apex and are systolic. Mackenzie found 66.6 per cent.of 31 cases of chorea examined from

one to five years after the attack marked by organic heart lesions. Osler reports $51\frac{3}{4}$ per cent. of the latter in his cases. There is seldom any alteration in the pulse. It is sometimes abnormally frequent.

The pupils are commonly dilated in chorea and respond sluggishly to light. Rosenthal, who once saw the dilatation of the pupil spontaneously disappear after the termination of the chorea, was not able, even by direct electrical stimulation, to change the pupil during the continuance of the disease; he therefore regards the phenomenon as the expression of a spasm of the dilator muscle, caused by irritation of the centre controlling it.

The reflexes are usually unaffected. Joffroy and Saric (L'Union méd., Sept. 22, 1885) found them abolished or diminished in 12 out of 16 cases of chorea. Shaw (Albany Med. Ann., May, 1897) has seen an exaggerated condition of the patellar tendon reflex.

SENSORY PHENOMENA.

Headache is common either before or after the attacks, and may be continuous or paroxysmal. Sir Thomas Watson has seen it limited to the side of the head opposite to the affected limbs. There is usually a diminution in cutaneous sensibility, especially on the parts most affected by the spasms. In many cases sensorial disturbances analogous to those of hysteria are observed. Painful phenomena also occur; sometimes

there is a tegmentary dysaesthesia predominating in the regions where the convulsions are strongest, at other times there are pains within the muscles, or in the joints at the level of the epiphyseal lines, neuralgia, chiefly in the course of the sciatic, and sometimes distinct tenderness of the nerves on pressure. Stiebel remarks upon the frequency with which he found sensitiveness of single vertebrae to pressure. Other observers, notably Hesse, have been unable to confirm this observation, and regard it as due to the nervous or hysterical condition of the patient.

TROPHIC DISTURBANCES.

Some disturbance of nutrition may be observed. Patients sometimes rapidly lose flesh, and become anaemic; the skin grows dry; the hair grows harsh, and there may be alopecia areata. There may also be loss of pigment in patches in the skin and hair, or the former may become pigmented. In severe cases the appetite and digestion suffer in proportion to the duration of the disease, the patient emaciates, loses in weight, and grows anaemic and feeble. The tongue is large, palid, and thickly coated, there is perhaps nausea and vomiting, and the bowels are constipated.

THE URINE.

Observers report variously as regards the condition of the urine. Beuce Jones found an excess of urea at the height of the disease. Albumen is not present

except from nephritis or accidentally, but there is usually an excess of phosphates and a diminution of calcium. Glycosuria has been recorded, and Garrod observed the pigment urohaemoporphyrin in the urine of 14 out of 20 cases of chorea. He cites this as a proof of the close relationship between rheumatism and chorea, in which former disease it was first discovered by M'Munn.

THE TEMPERATURE.

There is seldom any elevation of temperature in mild cases, in spite of the restless muscular activity. In severe cases, however, the thermometer has been known to register 104°F., and even higher in the presence of complications, or, in the absence of the latter, with the approach of a fatal termination.

MENTAL DISTURBANCES.

Mental disturbances are by no means unknown in chorea, but are usually, when present, of mild or moderate intensity. There may be a diminution of attention corresponding to the lessened motor energy and the perversion of the movements; a pronounced tendency to the perception of subjective sensations, hallucinations of sight particularly, sometimes of hearing, smell, and tactile sensibility, rarely of the genital sense; impairment of memory and of receptivity, and in consequence a change in character which becomes whimsical & irritable, while the conduct is often peculiar. The most sweet-tempered children become cross and perverse,

laugh immoderately at trifling things, or cry as readily if they are annoyed. There is generally failure of memory and incapacity for study or thought. In most cases, however, this exists to so slight an extent as not to be noticed except on very close observation. Sometimes there is marked mental disorder amounting to imbecility, and occasionally the mental weakness outlasts the motor disorders. Sometimes during the course of the chorea, but very exceptionally at the outset, maniacal delirium, often with hallucinations, may be observed. Occasionally the delirium is melancholic with a tendency to suicide. In cases of acute chorea recovery from the delirium is the rule; but in subjects with an hereditary taint choreic insanity may form the prelude to a precocious dementia or at least to a permanent intellectual degradation. Hesse is inclined to derive the frequent weakness of mind, the want of attention, the failure of memory, the incapacity for orderly thought and logical judgement, from the anaemia, the general bodily weakness, and the continual diversion of thought caused by the motor troubles.

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COURSE, DURATION, AND TERMINATION.

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The course of chorea is not always regular. In some cases the disease gradually reaches a crisis, remains stationary for a few days, and then by degrees

declines; in others there are exacerbations. The patient will seem to be almost well, and then become very much worse for a time.

The duration of the disease varies greatly. It usually lasts from one month to three or four months, but may extend over a year or longer. Wicke observed an average duration of 89 days from 125 cases, of which the duration was accurately known; and Sée, an average duration of 69 days in 117 cases. According to Moynier's statement, the duration was different in the two sexes, being in girls from 33 to 37 days, in boys from 74 to 81 days. Gray and Tuckwell (Lancet, Nov. 28, 1876) in a series of cases treated by the expectant plan, found an average duration of ten weeks. Hillier also obtains an average duration of ten weeks from 30 cases. The British Medical Association Collective Investigation Report, as amended by Gowers, shows that 57 per cent. of all cases last between one and three months. Occasionally a patient is seen with an attack of chorea which lasts only a few days.

Recurrence in chorea is said to occur in over one-third of the cases. A child who has had the disease one year may have it a second or third year. See observed 37 recurrences among 158 cases; of these, 17 had but one return of the disease, 13 had two, and 6 had chorea three times. Rufz and Romberg report cases of six attacks. As many as 10 or 12 have been recorded;

but it is to be doubted that some of the alleged repeat attacks are such in fact, as it is probable that a close examination during the intervals would reveal some symptom or other of a choreic condition. Some patients suffer from chorea every spring for years. Meldner (Wochenbl.der Gesellsch.der Wiener Aerzte, 1869) had a patient who developed chorea in early life and remained choreic until his death at the age of sixty-five years. Of Wicke's 35 cases of recurrence, 13 were in the spring, 12 in winter, 9 in autumn, and 1 in summer.

The termination of chorea is in most instances by a complete recovery, but sometimes there is nervousness or want of co-ordination remaining for a time. Rarely the latter, or a certain quickness in executing certain movements, grimaces, etc., may persist for years, and in a few cases never disappear.

Except in complicated cases or in pregnancy death is a rare termination of chorea. In pregnancy the mortality is great. Of 64 cases collected by Wenzel 18 died, giving a mortality in chorea gravidum of 27.3 per cent. Apart from pregnancy, death from chorea is by no means rare in adults. Hutchinson (Phila. Med. Times, vol. VI, p. 535) reports a fatal case in a boy of twelve years. After complaining of headache and rheumatic pains for several days, choreic movements began. They soon became general and very violent. On admission to the

hospital the patient was so extremely convulsed that it was impossible to keep him in bed without tying him. Up to the time of his death, two days after admission, the movements continued almost incessantly. Hunt (Pennsylvania Hosp.Rep., vol.II) reports another case of unusual interest. The patient, a man of twenty-nine years, had suffered from chorea of the face and arms for years. In consequence of a fall on the pavement he fractured the left humerus. The movements were immediately exaggerated, and in spite of a carefully adjusted splint it was impossible to keep the arm at rest. The fragments were in a state of constant movement, and the points of bone threatened to penetrate the skin. The skin was so much excoriated that it was determined to dispense with the splint and attempt to keep the limb at rest, by the administration of morphia hypodermically in half-grains doses three times daily. This failed to keep the arm quiet, and the seat of fracture became greatly inflamed. No form of appliance or medication succeeded in keeping the arm at rest, and the patient finally sank and died from exhaustion on the tenth day after admission to the hospital. The autopsy revealed no gross lesion of the brain or spinal cord; and no microscopical examination was made of either.

Death is usually to be assigned, on the one hand, to the intensity of the disease itself; on the other, to many serious affections and complications, as myelitis,

meningitis, encephalitis, endocarditis, and embolisin. In the cases which seem to be caused by the chorea itself, death occurs from the violence and incessant recurrence of the choreic movements which prevent alimentation and sleep and lead to a progressive debility and coma, in the midst of which the patient collapses.

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D I A G N O S I S .

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The motor symptoms of chorea are so distinctive that it is not easy to mistake them for anything else. In particular it is scarcely possible to confound it with paralysis agitans and disseminated sclerosis. The former occurs only in adult life, and the tremor is of a regular rhythmical character. In the latter the tremor occurs only on voluntary effort, and is also more regular than the movements of chorea.

There are forms of congenital sclerosis seen in children which closely resemble chorea, but the former is distinguished from the latter by the duration of the disease and the accompanying contractures.

Cases of imitative or possibly hysterical chorea may at first sight so closely resemble the true chorea as to lead to a mistake in diagnosis; but in hysterical cases, the perfect rhythm of the movements, the atypical onset, the prolonged duration of the disease, and

the general bearing and history of the patient, will suggest the hysterical nature of the malady.

Chorea may be distinguished from the spasms of paramyoclonus multiplex by the fact that the latter do not affect the face, are provoked by peropheral excitations, and may become tetanic. The movements of the fibrillary chorea of Morvan present the same characters and likewise cease during the execution of voluntary movements, but they implicate only a certain number of fibres or bundles instead of the entire muscle.

The so-called electric chorea of Bergeron or electrolepsy present only a superficial resemblance to true chorea, and differs from the latter by its benignancy and by the character of the spasms which implicate the neck in particular and are sharp, and rhythmical.

Chorea has sometimes been diagnosed when the condition has really been one of double athetosis. The latter is a disease of childhood, but has also been observed in adolescents and adults, and is characterised by voluntary, slow, and undulating movements that manifest themselves equally during the voluntary acts which exaggerate them and in their intervals, sometimes persisting during sleep. These movements invade the face and the trunk, as well as the limbs which are affected especially in their peripheral parts; the fingers are agitated by particularly characteristic undulations. These movements are associated with permanent

stiffness and sometimes with an increase of the volume of the limbs. Athetotic patients often have convulsive attacks and intellectual disturbances.

The so-called paralytic chorea - described by Todd - is a special form of the malady as is particularly liable to be confounded with the paralytic manifestations of hysteria. It is characterised by the exaggeration of the paretic state habitually present in chorea, and this may involve a variable number of muscles. The paralysis runs a different course in different cases. Sometimes it appears suddenly, independent of any spasm, and is heralded by a peculiar mental state, changes of character, a certain amount of stupor, and some awkwardness; at other times, in the course of an ordinary chorea which has manifested itself normally for two, three, four, or more days, the paralysis takes the place of the disordered movements; again, in other cases, the chorea appears to run a normal course, the movements moderate, and recovery seems at hand, when the paralysis sets in. Finally, after certain intense choreas in which the spasms are incessant there may be pyrexia, anorexia, a pronounced saburral state, and adynamia; the paralysis which then follows and becomes general is often a precursory sign of a fatal termination. The paralysis may implicate all the extremities, one half of the body, or a single member; in other instances it is limited to the muscles of the neck, and

the head having lost its support drops forwards or backwards. From time to time there may be observed the occurrence of indistinct choreic spasms, and the tongue which is generally spared by the paralysis continues to be agitated by spasms. Choreic paralysis is never followed by contracture but remains flaccid; as a rule it is not associated with an anaesthesia as marked as that accompanying hysterical paralysis, but often enough the sensibility is affected. Exceptionally there may be incontinence of urine and faeces. The tendon reflexes are generally abolished. The reaction of degeneration is not observed, but sometimes a rapid atrophy supervenes, which has been explained by a mechanism analogous to that given by Rondot in explanation of the atrophies of articular origin, in view of the frequency with which choreic patients suffer from articular lesions.

In Huntingdon's chorea (chronic progressive chorea) there will be a history of the disease dating back for generations and affecting many members of a family, and of its developing in early adult life. It is characterised by irregular muscular contractions, incoördination, and progressive dementia. It occasionally alternates with idiocy, epilepsy, and various degenerative conditions. It appears to be endemic in certain localities, and still exists where Huntingdon, in 1872, first observed it, viz., in Long Island. It is only likely

to be mistaken for senile chorea with dementia, but in the latter the mental disturbances, if existing, are trifling, the motor symptoms more violent, and the strictly hereditary character of the malady is lacking.

It is scarcely possible to confuse chorea with epileptiform convulsions, for the attacks of the latter are less frequent, and there is generally some momentary loss of consciousness, besides other symptoms pointing to epilepsy.

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P R O G N O S I S .

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As a rule the prognosis of chorea is decidedly favourable. If the disease occurs in childhood and is without complications, recovery generally takes place spontaneously in a few weeks. Should the movements be violent and continuous, so as to interfere with sleep and the taking of food, or should there be any complication, such as acute rheumatism or cardiac disease, then the prospect of recovery is not so good. Death is a rare termination in uncomplicated cases, especially in children. The fatal cases are generally when acute rheumatism has been associated with the chorea or when there has been a fracture or injury as a complication. In Sée's statistics there is a mortality of 5·7 per cent in 158 cases in the Children's Hospital. Death

occurred in only 2 per cent of the cases collected by the British Medical Association Investigation Committee. Sinkler states that in Philadelphia in seventy-four years there have been only 64 deaths from chorea. In adults, and more particularly in pregnant women, death is more common. Wenzel's cases referred to above gave a mortality of 27.3 per cent. Chorea gravidum, whilst furnishing a high mortality for the mother, more often destroys the foetus. Abortions during pregnancy are very frequent, and owing to the serious condition of the patient may have to be artificially induced. The danger of relapses under unusual strain or excitement should be remembered. The prognosis as to relapses should be given with caution. If in a child, it is possible that there will be a return of the disease after a longer or shorter interval. It is not likely to recur until after several months, usually at about the same season the following year. As the child grows older the intervals become longer, and it may be asserted that after puberty is passed and bodily development completed the malady will not again return.

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T R E A T M E N T .

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There is no specific treatment for chorea; and owing to the complexity of the pathogeny the therapeutic indications are very variable. There is every reason

to believe that some of the milder cases of chorea would get well without any treatment whatever; but no disease, not even epilepsy, calls for more active treatment than chorea does in its severer forms. A vast number of remedies have been popular in this disease from all ages.

The drug which is most generally depended upon at the present day is arsenic. It is advised by most writers, and in my own experience is decidedly the most reliable remedy for chorea that is known. The best way to administer it is in the form of Fowler's solution, and it should be given in large doses. Arsenious acid and arseniate of sodium, or bromide of arsenic may be given, but are not superior to Fowler's solution. The amount of arsenic which can be safely borne by children with chorea is surprising to those who have not had experience in its administration. It should be given in gradually increasing doses until the toxic effects are well marked or until the patient is convalescing. To a child of six years three drops of Fowler's solution may be given to begin with, three times a day. One drop additional should be added to each dose each day, and the child soon acquires a remarkable tolerance of the drug...As much as twelve or fifteen minims at a dose is borne by a child of eight years. If vomiting or much oedema of the face occurs, the medicine should be stopped

for a day or two; and then the original dose should be taken, and again gradually increased. Senguin recommends that the patient should begin again with the dose at which tolerance ceased. For instance, if vomiting occurred after a dose of nine drops, he stops the medicine for a day, and begins again with eight drops. He holds, and with good reason, that if arsenic does not succeed more frequently it is because it is used in insufficient doses; according to him, massive doses are less dangerous than small doses long continued. The toleration of the drug will be facilitated by diluting the solution with a tumblerful of carbonated water, alkaline or acid, which is taken in two or three portions during the hour following the meals. It is often seen that a patient becomes worse the first few days that the arsenic is taken, but the improvement generally begins after a week of its exhibition, and is well marked within the next fortnight or so. In obstinate cases it is of marked advantage to give the arsenic hypodermically. Cases which do not yield to the drug when given by the mouth often improve at once when it is injected subcutaneously. Chronic cases which have resisted all forms of medication sometimes are cured in this way. Fowler's solution is thus used by Riedcliff, Eulenburg, Widerhofer, Fröhwald, among others. The pain of injections may be diminished - important in children - by substituting cherry-laurel water for the water of

the ordinary solution.

Numerous other drugs enjoy a reputation in the treatment of chorea. Sulphate of zinc is relied upon by many, and is the means with which Ross and Butlin (Lancet, 1871, Nos. 17, 18) The latter observer begins with small doses and increases to emetic ones, but as soon as nausea is produced he goes back to smaller doses, or suspends the treatment entirely. He has never failed to observe an improvement in the symptoms, and frequently a cure. I am in the habit of giving it in increasing doses like arsenic. Very large doses may often be taken without disturbing the stomach, and the two remedies may be combined. The oxide of zinc has been recommended by Hufeland in doses of fifteen grains three times a day. Steiner combines it with saccharated carbonate of iron in anaemic cases.

Trousseau, Hammond, and Hamilton favour strychnine, but in spite of their confidence in the drug, it remains under suspicion. Their object was, it seems to substitute tetanic contractions for the clonic movements. Trousseau gave it in the form of a syrup containing $\text{gr. } \frac{3}{4}$ to 3 III of the sulphate, in doses of $\text{m. } \frac{1}{2}$ to 1. a day.

Cimicifuga sometimes does good when arsenic fails. From fifteen to thirty drops of the tincture may be given three times a day, as first recommended by Hiram Corson. The combined use of this drug and arsenic is

sometimes more prompt and efficient than the latter alone, particularly in protracted cases.

The patient in the earlier stages of chorea must obtain sleep at all costs. Bastian has kept his patients who were seriously affected for weeks in a sleep which was interrupted only for meals. Prolonged sleep is all the more indicated since insomnia plays in the production of the attack a part which is more pronounced in proportion to its persistence. Besides, the movements cease during sleep, allowing, says Lasèque, the patient to accumulate nerve force. In order to secure it some resort to the use of chloroform or ether inhalations, twice daily to a point of resolution. Ziegler recommends nitrite of amyl for inhalation in doses of from three to ten drops three times a day, but such would be justifiable only in cases of great urgency.

Of other commonly used hypnotic drugs chloral has been found most useful. It was recommended over thirty years ago by Sir William Gairdner and Dr Charton Bastian. There is no question that the sleep induced by chloral causes a cessation of the agitation. The object to be attained is prolonged sleep and thereby a suspension of the movements; to this end it is necessary to commence with fifteen grains of chloral and increase the dose by seven grains daily; the drug being stopped only when depression of the pulse or symptoms of gastric irritation supervene. It should not be

forgotten that chloral is always dangerous in subjects suffering from heart disease. Often when sleep for from twelve to sixteen hours a day has been obtained the movements moderate and cure results; but there is no gainsaying the fact that in a fair number of cases this cure does not occur untill the disease has run its usual course; and, finally, it is often observed that the movements, though calmed while the prolonged sleep is maintained, recur with their former violence when the patient awakes.

Sulphonal paraldehyde, and chlorolose have been used in the same manner as chloral, and the same remarks apply to it as in the case of the latter remedy. Paraldehyde acts both as a hypnotic and as a calmative upon the reflex actions of the spinal cors, and has the advantage over chloral of not depressing the heart. It may be given doses of from one-half to one drachm daily. Sulphonal may be administered in wafers or suppositories in doses of from ten to thirty grain a day. Chlorolose does not act upon the spinal cord, but has a special hypnotic effect upon the brain, and may, therefore, be used to produce prolonged sleep in chorea.

Jaccond recommends opium in heroic doses for the production of sleep in young children. The obvious danger of the procedure have debarred others from confirming his experiences with the remedy.

Various drugs of the antispasmodic class have been

much used in chorea.

Except when combined with chloral, the bromides are of singularly little value in chorea. They are useful thus administered to allay the headache induced by chloral; and they are said to be of occasional value in chorea gravidum.

De costa (Phila.Med.Times, Jan 23, 1886) has reported a case of very severe chorea successfully treated with hyoscyamine. The patient was a boy of eleven years, and the disorder had followed an attack of rheumatism. The dose used was $\frac{1}{100}$ gr. three times in the twenty-four hours. In doses of $\frac{1}{32} - \frac{1}{6}$ it has also given good results in Oulmont's practice. It is especially valuable in cases complicated with acute mania. Hypodermic doses of hydrochlorate of hyoscine ($\text{gr. } \frac{1}{64} - \frac{1}{32}$) are advised by Mangan in adult cases of a grave intensity.

Wallner, of Munich, was the first (in 1887) to advocate the exhibition of antipyrin in chorea. Some rapid cures, in a few days, have been reported with this drug, and its effects seem to be generally favourable; but some altogether refractory cases have been published. Moncorvo advises its exhibition in doses of eight grains, increased by the same quantity every day, until two drachms are taken daily. In certain cases it produces albuminuria or unpleasant symptoms, so that the patient taking it requires to be closely watched.

Of somewhat analogous action is exalgine, a drug warmly advocated by Loewenthal and Dana, in doses of four grains, increased by the same amount daily up to fifteen grains, a day for a child of seven years.

Belladonna and atropine, with or without valerian an asafoelida, have been recommended.

Sulphate of eserine ($\text{gr. } \frac{1}{30} - \frac{1}{12}$) is highly spoken of by Bouchut. It has, however, been proved dangerous in many cases, and of little service in the hands of Riess, Gubler, Cadet de Gassicourt, and others.

Tartar emetic is seldom used nowadays. It used to be a favourite remedy with Laeunec, Gillette, and Bouley. Williamson (Lancet, Aug. 22, 1903) has tried aspirin in 35 consecutive cases of chorea, in which he was able to shorten the attack. He found it particularly reliable in severe and obstinate cases. Though occasionally causing gastric disturbance, it did not exhibit any toxic action. He commences with ten grains twice a day, for children over seven years, and rapidly increases the dose to ten or fifteen grains four times a day.

Edsall (Annals of Gyn. and Pediat., Mar., 1904) reports a case of chorea of a septic type which he treated with intravenous injections, which lowered the temperature and appeared to be in other respects beneficial.

Presuming every case of chorea in children to be rheumatic and of the nature of a "cerebral rheumatism", Lees (Brit. Med. Jour., Aug. 29, 1903) treats his patients

with the salicylates in large doses, e.g., 100 grains a day, increased to 200, for a child from six to ten years of age. With each dose of the salicylate he gives double the amount of bicarbonate of soda, in order to prevent salicylic acid-hunger. If unpleasant symptoms are produced he discontinues the drug for a few days, and begins with a smaller dose. Ewart (Brit. Med. Jour., Aug. 29, 1903) thinks that the carbonic-acid gas generated from the bicarbonate of soda is the secret of Lees's good results. In 4 cases of chorea, which had resisted arsenic, etc., and in which there was no symptom of cardiac or rheumatic trouble, Zaoussalor (La Sem. Med., XXIV, No. 9) obtained immediate benefit from salicylate of soda in the usual doses.

In 2 cases of chorea Burnet saw a rapid subsidence of the symptoms after the repulsion of the taenia solium, other treatment having signally failed.

Vargas (Ann. de Med. et Chir. Inf., July 14, 1904) has been very successful in treating chorea with hedonal, in doses of 7 to 15 grains; some of his cases were cured in a week.

Tonics, such as iron, quinine, and cod-liver oil, are always of use in chorea, especially during the convalescence. Da Costa uses the bromide of iron.

It is scarcely necessary to mention the other remedies which have been proposed for this disease. Wood has used a preparation of skunk cabbage, and they are a

great number of other agents which are of no use whatever.

External agents come next to internal means in point of utility. Of such we have revulsives, electricity, hydrotherapy, gymnastics, and massage. As revulsives have been employed light ignipuncture along the vertebral column, tincture of iodine, and ether chloride of methyl sprays, and the application of an ice-bag for ten minutes once or twice a day. Electricity was advised by Erb and others, and used in all its forms. The general sedative action of the galvanic current may be employed to some advantage, particularly in the evening when it will help to bring on sleep. A moderate stable current (15 to 20 cells, not above 10 milliamperes) will suffice for this purpose when applied to the spine. Hydrotherapy is mainly to be recommended as a tonic. The cold baths by immersion which were successful in Dupuytren's hands seem to act chiefly by shock; but, apart from this, the bathing process constitutes a veritable gymnastics of the skin, the activity of which influences all the functions. Cold water has much the most intense action, and it is that which frequently renders the greatest service. Hot water in the form of douches or baths is indicated when we have to combat a too intense excitation or a violent delirium. Hydrotherapeutic measures are likely to prove beneficial in the convalescence. Bandelocque advocates

sulphur baths, and Cadet de Gassicourt sulphur douches. It is nearly a century since gymnastic exercises were recommended for the regulation of the voluntary movements. Blache, Jolly, and Louvet-Lamarre advised exercises of precision, leaping, dancing and pianoforte practice; but it was Laisné in particular who made a systematic application of gymnastics in 1847. Germain Sée, Blache, and Bouvier recognised the utility of the method. In order to re-establish the influence of the will upon the movements it is necessary to have recourse to simple exercises in which the patient executes with precision movements which he sees performed before him and which are exactly explained to him. The most useful movements are those which are performed with an exact knowledge of their direction, extent, energy, and rapidity. The patients profit greatly by exercising before a mirror which permits them to regulate the movements with exactitude. The exercises should include the different qualities of movement - exercises of direction, placing the hand or foot or the finger upon a given point; exercises of force, making a given traction on an apparatus with springs; exercises of rapidity, carrying a finger to one or several points, one or more times, in a given time, and so forth. The exercises of the limbs should be combined with exercises of respiration whose regularity serves a point of support for every effort; in this respect the exercises

which are employed in the education of deaf-mutes may be utilized. A general rule is that the learning of non-adapted but well-regulated movements is most useful for regulating adapted movements. Laisné had already made the very correct observation that when the patients came from a great distance they were profited much less by the gymnastics. This is because the education of the consciousness of movement demands attention, and because the attention, which is already deficient in choreics, becomes still weaker under the influence of fatigue liable to result from a long walk. It is therefore indispensable that the gymnastic exercises should never be carried to fatigue; the practices must be short and repeated. Passive movements may prove very useful not only by their action upon the muscles but also because they recall regular motor images; after a movement that has been passively executed several times its voluntary performance becomes not only more rapid but more energetic. A useful adjunct to the gymnastics is massage. It tends to improve the general nutrition, and may possibly in itself lessen the involuntary muscular contractions. The amount of bodily exercise to be taken should be determined according to the indications of the special case. When the chorea is violent in the lower extremities and the trunk, walking is not to be thought of; the patient must be driven about or allowed to sit undisturbed in the open air. In

cases of symptomatic chorea due to spinal or cerebral disease gymnastic exercises, etc., must never be instituted.

One of the most important factors in the general treatment of chorea is rest both of body and mind. It is of the greatest value in severe cases to place the patient in bed and keep him there until the symptoms improve. Bibber, of Baltimore, has treated a number of cases of chorea successfully by keeping them secluded in a dark room. Such an extreme degree of isolation is not often necessary, and it might make a child more nervous. All occasions for mental excitement must be removed. The child must be taken at once from school, and all brain-work and exciting play must be stopped. Plenty of fresh air and wholesome food should be insisted upon. Change of air to the mountains or to the seaside often effects a cure in a short time. Poor patients usually rapidly improve under the regularity, care, and quietness of a wellordered hospital. Grave cases should be prevented from injuring themselves by restraint under a suitable apparatus.

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B I B L I O G R A P H Y .

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- Sydenham: Latham's Translation of his works, vol. II, p. 198, Sydenham Soc. ed.
- Wichmann: Ideen zur Diagnostik, III, Ausg., Hannover, 1827, Bd. II.
- Ketterling: Darstellung des Veitstanzes, Regensburg, 1805.
- Bouteille: Traite de la choree ou danse de St. Guy, Paris, 1810.
- Bernt: Monographia Choreae St. Viti, Prag, 1810, Dent. Ausgabe mit Zusätzen von Sohler. Prag, 1826.
- Wagner: Pathol.-therap. Abhand. ueber den Veits., Warzb., 1817.
- Rufz: Arch. gen., 1834, Fevr., p. 215, ff.
- Roth: Dissertation. München, 1843.
- Wicke: Versuch einer Monograph. des grossen Veits. und der unwillkürlichen Muskelbeweg., Leipzig, 1844.
- Sée: De la choree. Mem. de l'Acad. nat. de Med., vol XV, Paris, 1850, p. 373, ff.
- Lendet: Sur les chorees sans complic. Terminees par la mort. Arch. gen., Sept., 1853, p. 285.
- Romberg: Lehrbuch der Nervenkr., Bd. I, S. 510, ff. Berlin, 1853, und Klinische Ergebnisse. Berlin, 1846, S. 19 ff.
- Todd, R.B.: Clinical Lectures on Paralysis, 2 d. ed. London, 1856, pp. 428 et seq.; and Lectures on Chorea. Lancet, April, 1843.
- Moynier: On the Treatment of Chorea. Arch. gen., July, 1854; Jour. de Med. de Brux., 1858, No. 59.
- Mosler: Chorea bei Schwangeren. Virchow's Arch., Bd. XXIII, S. 149, 1862.
- Kirkes: On Chorea; its Relation to Valvular Disease of the Heart; and its Treatment. Med. Times and Gaz. 1863, Nos. 677, 678.
- Bricheteau: Arch. gen., 1863, I, pp. 433, 532.
- Hillier: Chorea in Connection with Heart Disease. Med. Times and Gaz., 1863, Aug. 8, p. 142.
- Fischl: Chorea minor in gravida. Wiener allg. med. Zeit., No. 16, 1865.
- Hine: A case of Myelitis, presenting all the Symptoms of Severe Chorea; Death on the Ninth Day; Autopsy. Med. Times and Gaz., 1865, '788.
- Cyon: Med. Jahr. Zeit. der gessellsch. der Wiener Aerzte. Bd. XXI, p. 115, 1865.
- Russel: Med. Times and Gaz., 1866.
- Moncton: A case of Chorea ending fatally, complicated with Disease of Heart and Brain. Brit. Med. Jour 1866, No. 305.
- Roger: Clinical Researches on Chorea, on Rheumatism,

- and the Heart Disease of Infants. Arch. gen., 1866, II, 1867, I, 54-75.
- Richter: Sitzungsber. der Dresdener gesells. f. Natur- und Heilk., 5 Jah., 1867.
- Tuckwell: Some remarks on Maniacal Chorea and its probable connection with Embolism. Brit. and For. Med. Chir. Jour., Oct., 1867.
- Wilks, Sam.: Med. Times and Gaz., 1868, p. 117. Brit. Med. Jour., July 30, 1870, p. 115.
- Ogle, J.W.: Remarks on Chorea St. Viti. Brit. and For. Med. Chir. Rev., Jan., 1868.
- Meynert, Th.: Allg. Wiener med. Zeit., 1868, Nos. 8, 9.
- Arndt, R.: Chorea und Psychose. Arch. f. Psychiatrie und Nervenkr., Bd. I, 1868.
- Steiner: Prager Viertl. jh., 1868, IV, S. 45; Jahr. f. Kinderh. N.F. III, S. 291, 1870.
- Kretschmer: Dissertation. Berlin, 1868.
- Jackson, J. Hughlings: Observations on the Physiology & Pathology of Hemichorea. Edin. Med. Jour., Oct., 1868, p. 294; Med. Times and Gaz., Mar. 6, 1869.
- Douglas: On the Use of Indian Hemp in Chorea. Edin. Med. Jour., Mar., 1869, p. 777.
- Barnes: Chorea in Pregnancy. Med. Times and Gaz., Aug. 1, 1868; Obstet. Trans., 1869, X, p. 147.
- Tait, Lawson: Dublin Quart. Jour., Feb., 1869, p. 203.
- Broadbent: Remarks on the Pathology of Chorea. Brit. Med. Jour., April. 17, 24, 1869.
- Carville: Gaz. méd. de Paris, 1869, No. 50.
- Said, M.: Thèse. Paris, 1869.
- Leidesdorf: Woch. der Ges. der Wiener Aerzte, 1869, Nos. 12, 13.
- Weber, Fried.: Berl. Woch., 1870, VII, 5.
- Russel, J.: Med. Times and Gaz., 1868, May 30; 1869, Jan. 16; 1870, Jan. 8; April 2.
- Frick: Dissertation, Berlin, 1870.
- Legros and Onimus: Researches on Choreiform Movements in the Dog. Comptes rendus, 1870, LXX, p. 1046.
- Fox, E.L.: Med. Times and Gaz., 1870, p. 423.
- Gray: Ibid., Dec. 17, 1870.
- Clouston: Jour. of Mental Sci., 1870.
- Sieckel: Chorea gravidum. Inaug. Diss. Leipzig, 1870.
- Gray and Tuckwell: Cases of Chorea treated on the Expectant Plan. Lancet, Dec. 2, 9, 1871.
- Meyer, L.: Chorea and Mania. Arch. f. Psychiatrie u. Nervenkr., II, S. 535, ff., 1871.
- Dickinson: Clinical Lectures on Chorea. Lancet, 1871, I, 15.
- Butlin, H.T.: Cases of Chorea, treated with Sulphate of Zinc. Lancet, 1872, Nos. 17, 18.
- Ritter: Gedanken ueber die anatom. Grundloggen der Chorea. Memorabilien. 1872, No. 16.
- Huntingdon: On Chorea. Phila. Med. and Surg. Reporter, 1872 p. 15.
- Jones, C.H.: Clinical Lectures on Cases of Chorea. Med.

- Press and Circ., Jan. 10, 1872, p. 25.
- Fehling: Chorea gravidum. Arch. f. Gyn., 1873, VI, 1, S. 137.
- Arnoldi, R.: On Chorea gravidum. Diss. Inaug., Berlin, 1873.
- Foot, A. W.: Unilateral Chorea; Disease of the Corpus Striatum and Optic Thalamus on the side opposite to affected. Dublin Jour. Med. Sci. Oct 1873.
- Fox: Congenital Chorea. Brit. Med. Jour., 1873, No. 653.
- Landouzy: Gaz. Med. de Paris, 1873, No. 24.
- Leube, W.: Klin. Beil. zw den Corresp. d. Allg. aerzth. Vereins von Thüringen, 1874, No. 5.
- De Beauvais: Two observations on Chorea Fatality. Gaz. des Hôp., 1874, Nos. 150, 151.
- Pye-Smith, P. H.: Guy's Hosp. Rep., 3 Ser., XIX, 1874, p. 341.
- Mitchell, Weir: Post-paralytic Chorea. Amer. Jour. Med. Sci 1874, vol. CXXXVI, p. 352 et seg.
- Golgi, C.: Revista clinica, 2 S., IV, 12, p. 361. Bologna, 1874.
- Benedikt, M.: Nervenpathol. und Elektrotherapie. II, Aufl. I. Abth., S. 251 ff., Leipzig, 1874.
- Gotthold: On Chorea. Diss. inaug. Würzburg, 1874.
- Wenzel, Bodo: On Chorea major and minor. Schmidt's Jahr. Bd. 162, S. 193 ff., 1874.
- Weinberger: Wiener med. Presse, XV, 1874, No. 47.
- Pollock: Treatment of Chorea with Inhalations of Chloroform, Lancet, 1874, I, 25, p. 871.
- Elischer: Virchow's Arch., 1874, Bd. 61; S. 485 und Bd. 63, 1875, S. 104 ff.
- Rosenthal, M.: Klin. der Nervenkr., II, Aufl. S. 576 ff., Stuttgart, 1875.
- Charcot: De l'hémichorée post-hémiplégique. Progr. méd., 1875, Nos. 4, 6; and Gaz. des Hôp., 1875, No. 30.
- Hofmeyer: Von der Grübel- und Krumen- oder Schweren. Berlin, 1742.
- Brendel: Praelectiones academicae. Bd. II. p. 86 et seg., 1793.
- Bouteille: Traité de la chorée. Paris, 1809.
- Schaeffer: Salzburger med. Chir. Zeit. 1793, IV, S. 248.
- Thilenius: Med. chir. Bemerkungen. Th. II. S. 4 ff. Frankfurt a. M., 1814.
- Franque: Jour. f. Kinderh., 1867, S. 226.
- Bohn: Jahr. f. Kinderh., 1874, S. 194.
- Wysocki: Wiener med. Woch., 1875, Bd. XXV, Nos. 14, 15.
- Hirsch: Historisch-geograph. Pathol., 1874, Bd. II., S. 570.
- Siekel: Inaug. Diss. Leipzig, 1870.
- Weber: Berl. Klin. Woch., 1870, VII. 5.
- Davis, Hall: Lancet, II, Oct. 15, 1868.
- Fehling: Arch. f. Gyn., 1873, VI, 1, S. 137.
- Duges: Essai physiol.-pathol., Paris, 1823, I. 1, No. 23.
- Stiebel: Klin. Beit. z. Heilwissen. Frankfurt a. M., 1823, pp. 43-67.
- Reeves: Schmidt's Jahr., 1874, Bd. CLXI, p. 131.
- Gintrae: Jour. de la soc. de méd. de Bourdeaux, April, 1845.

- Froriep: Neue Notizen a.d.Geb.der Natur-und Heilk.,No. 224,p.57.
- Frerechs: Dissert.of Arnoldi and Fricke.
- Rokitansky: Ueber die Bindegewebe, etc., Sitzungst.der Wiener Akad.der Wiss., 1857.
- Ritti: Un.Med., 1873, CXXXII. Virchow-Hirsch, Jahresb. 1873 II, 1, S.42.
- Chaveau: Arch.gén.de méd., March, 1866.
- Gull: Guy's Hosp.Reports, 1861 and 1862.
- Kussmaul: Wörzb.med.Zeit., 1863, Bd.IV, S.56 ff.
- Leyden: Volkmann's Sammlung Klin.Vortr., 1870.No.2.
- Feinberg: Berl.Klin.Woch., 1871, No.4.
- Fischer: On Neuritis. Inaug.Diss.Königsberg, 1869.
- Klemn: On Neuritis migrans. Inaug.Diss.Strassburg, 1874.
- Eulenburg: Zur Therapie des Tremor u.d.Paralysis agitans. Berl.Klin.Woch., 1872, No.46.
- Smith, Lewis: Med.Rec., 1872.
- Bergeret and Mayencon: Saltz of Copper in the treatment of Chorea. Jour.d l'Anat.et de Physiol. 1874, p.1.
- Bouchut: Bull.gen.de therapeutique, 1875, No.IV.
- Rougier: Recherches sur la morphine et la strychnine. Lyon, 1843.
- Fouilhoux: Gaz med.Paris, Oct., 1846.
- Trousseau: Bull.de l'Acad.de Med., 1846, T.XII, p.397.
- Gairdner: Glasg.Med.Jour., 1870, p.550.
- Caruthers: Lancet, April 2, 1870, p.501.
- Briess: Wiener med.Presse, 1870, No.5, p.102.
- Verdalle: Bull.gen.de therap., Feb., 1873.
- Hecker: Epidemics of the Middle Ages. Trans.Syd.Soc.
- Modestus: Cited by Hecker.
- Taylor: Phila.Jour.of Med.and Phys.Sci., May 12. 1826, 80
- Faure: Souvenirs du Medi, etc.
- Rigler: Die Türkei und deren Bewohner, etc., II, 291.
- Palgrave: Union med., 1866, 308.
- Borchgrevink: Norsk Mag.for Laegevidensk, 1872, 241.
- Premier: Krankh.des Orients, 303.
- Bertherand: Med.et hygiene des Arabes. Paris, 1855.
- Borius: Arch.de med.Nav., May, 1882, 370.
- Ballay: L'Ogoone, etc. Paris, 1880, I, 114.
- Auboeuf: Contribution to the Study of the Hygiene and Diseases of India. Paris, 1882, 60.
- Dudgeon: Glasg.Med.Jour., July 1877, 331.
- Rufz: Arch.gen.de med., Feb., 1834; Arch.de med.nav., Oct 1869, 260.
- Newton: Med.Topogr.of the City of Mexico. New York, 1848
- Jourdanet: Le Mexique, etc. Paris, 1864, 411.
- Lebert: Handb.der pract.med. Tübingen, 1859, II, 529.
- Mitchell, W.: Lectures on Diseases of the Nervous System, 1885, 2d.ed.
- Stahl: Ratio medendi, IV, 78.
- Uwins: Edin.Med.and Surg.Jour., Oct., 1812, 408.
- Bricheteau: Arch.gen.de med., April, 1863, 433; May, 532.

- Mullin: Edin.Med.and Surg.Jour.,Jan.1, 1805, 31.
 Soltmaun: Gerhardt's Manual,vol.V.
 Sinkler: Jour.of Nervous and Mental Diseases,July,1881
 British Medical Association Collective Investigation
 Committee: Brit.Med.Jour.,1887.
 Huntington: Med.and Surg.Reporter,1872.
 Peretti: Berl.Klin.Woch.,1885.
 McLeod: Jour.of Mental Dis.,1881.
 Zacher: Neurol.Centralbl.,1888.
 Hoffmaun: Virchow's Arch.,vol.XCI.
 Gowers: Dis.of the Nervous System,p.957.
 Lewis,Morris.: The Polyclinic,Jan.,1887.
 Hamilton,A.McL.: Amer.Psychol.Jour.,Feb.,1876.
 Roger: Arch.gen.de Med.,1886,XII.
 Brieger: Berl.Klin.Woch.,1886,No.10.
 Hirt: Pathol.und Therap.der Nervenkr.,p.397.
 Herringham: Lancet,Jan.12,1889.
 Cheadle: Ibid.,May 4,1889.
 Bouchand: Rev.mens.de l'Enfance,1889.
 Ruheman: Dissertation.Berlin,1889.
 Jones,Handfield: Brit.Med.Jour.,1889.
 Ogle: Brit.and For.Med.-Chir.Rev.,1868.
 Dana: Med.Rec.,Oct.19,1889.
 Handford: Brain,July,1889.
 Garrod: Lancet,Nov.23,1889.
 Grosse: Berl.Klin.Woch.,Aug.19,1889.
 Warner: Trans.Internat.Med.Congr.,1881,vol.IV,p.116.
 Hirschsprung: Jahr.f.Kinderh.,March,1881.
 Meldner: Woch.der Gesellsch.Der Wiener Aerzte,1869.
 Sachs and Paterson: Jour.of Nervous and Mental Diseases
 1890.
 Seguin: New York.Med.Jour.,Mar.21-May 31,1890.
 Bastian: Brain,1890.
 Schrötter: Wiener Med.Woch.,1889.
 Grasset and Rangier: Traite pratique des maladies du
 systeme nerveux,t.II,1894,p.667.
 Breton: Etat mental dans le chorée.Thèse,1893.
 Fonteneau: Contrib.à l'étude de la chorée gravidique.
 Thèse,1893.
 Guillemet: De la mort dans la choree de Sydenham.Thèse
 1893.
 Ballet,G.: Congenital Chorea.La Bull.med.,1896,p.223.
 Duchanteau: Essay on the Pathology of Sydenham's Chorea.
 Thèse de Paris,1893.
 Krafft-Ebing: Allg.Wien.med.Zeit.,1897,XLIII,pp.25,37,
 47.
 Moncorvo: Bull.de l'acad.de med.Paris,1898,XXXIX,p.574
 Pediatrics,1898,VI,p.337.
 Pritchard: Med.News,N.Y.,1896,LXIX,p.228.
 Roeser: Jour.d.Pract.Heilk.Berlin,1828,67,p.54.
 Sturges: On Chorea.London,1893,2nd ed.
 Tomkins: Amer.Jour.Obstet.,N.Y.,1897,XXXV,p.335.
 Stewart: Edin.Med.Jour.,March,1889.

- Osler: On Chorea and Choreiform Affections. London, 1894
- Mitchell and Rhein: Phila. Med. Jour., 1898, I, p. 153.
- Hughes and Burton Brown: Guy's Hosp. Reports, 1855, I, p. 217.
- Appenzell: Corres. Bl. f. schw. Aerzte, 1898, XXXVIII, pp. 408, 439.
- Goodall: Guy's Hosp. Reports, 1890, XLVII, p. 35.
- Huet: Thèse de Paris, 1889.
- Babington: Guy's Hosp. Reports, 1841, VI, p. 411.
- Bernt: Monographia Choreae St. Viti. Prague 1810.
- Cartier: Some Considerations on the Symptomatology and Nature of Chorea. Paris, 1876.
- Baxter: Brain, 1879-80, II, p. 124.
- Bright: Reports on Medical cases, 1831, vol. II, pt. 2, p. 468
- Hughes: Guy's Hosp. Reports, 1846, IV, p. 360.
- Richter: Western Lancet, XII, p. 529.
- Triboulet: Thèse de Paris, 1893.
- Turner: Path. Soc. Trans. Lond., 1892, XLIII, p. 8-117.
- Wollenberg: Arch. F. Psych. u. Nervenkr., 1892, XXIII, p. 167.
- Wood: Jour. of Nervous and Mental Diseases, 1893, XX, p. 241
- Bourneville and Katz: Prog. med. Paris, 1898, VIII, p. 33.
- Chéron: Gaz. des Hop. Paris, 1895, LXVIII, p. 1457.
- Churton: Internat. Clin. Phila., 1895, II, p. 119-197.
- Cemby: Med. mod. Paris, 1896, VII, p. 529.
- Cougnot: These de Paris, 1895.
- Fletcher, M.: St. Barthol. Hosp. Rep. 1897, XXXII, p. 383.
- Wichmann: Dent. med. Woch., 1890, pp. 632, 659.
- Ginzetti: Riforma med., Napoli, 1894, XXVI, p. 233.
- De Schweinitz: New York Med. Jour. 1887, I.
- Haushalter: Rev. med. de l'est, Nancy, 1894, XXVI, p. 233.
- Rauney: New York Med. Rec., 1894, XLV, pp. 551, 552.
- Legay: These de Paris, 1897.
- Lewis: Trans. Assoc. Amer. Phys., 1892, VII, p. 249.
- Litten: Charité-Annalen., 1884, XI, p. 265.
- Mackenzie: Brit. Med. Jour., 1887, I, p. 425.
- Maragliano: Centralbl. f. innere Med., 1899, XX, p. 489.
- Marfan: Sem. med., 1897, XVII, p. 153.
- Money: Brain, 1882, V, p. 513.
- Owen: Trans. Internat. Med. Congr. Washington, 1887, V, p. 157
- Peiper: Deut. med. Woch., 1885, XI, p. 116.
- Priestly: Brit. Med. Jour., 1897, II, p. 805.
- Rachford: Med. News, April 22, 1893, p. 429.
- Joffroy: Bull. et mèm. soc. med. des Hop., Paris, 1891, VIII, p. 143.
- Laveran: Ibid., p. 285.
- Seglas: Ibid., p. 164.
- Albert: Gaz. de Hop. Paris, 1895, LXVIII, p. 262.
- Auché: Progr. méd., 1891, XIV, p. 435.
- Auché and Carrière: Arch. clin. de Bourdeaux, 1895, IV, p. 74
- Dettling: These Lyon, 1892.
- Horcholle: These de Paris, 1888.
- Duckworth: Atti d. XI congr. med. internz. Rome, 1894, III, med. int. p. 354; Wien. med. Bl., 1894, XVII, pp. 192, 208.

- Garrod: Med.-Chir.Trans.Lond., 1889, LXXII, p.145; Lancet, 1892, I, p.793.
- Scheele: Dent.med.Woch., 1885, XI, p.702.
- Syers: Lancet, 1889, II, p.1271.
- Townsend: Trans.Amer.Pediat.Soc., 1892, IV.
- Menzies: Jour.Ment.Sci., 1892, XXXVIII, p.560; 1893, XXXIX, p.50.
- Morpurgo: Riv.sper.difreniat., 1898, XXIV, p.498.
- Oppenheim and Hoppe: Arch.f.Psych., 1893, XXV, p.617.
- Patry: These de Paris, 1897.
- Phelps: Jour.of Nerv.and Ment.Dis., N.Y., 1892, XIX, p.765.
- Remak: Neurol.Centralbl., 1891, X, p.326.
- Riesman: Amer.Jour.Med.Sci., 1897, CXIV, p.180.
- De Rossi: Clin.Med.ital.Milan, 1898, XXXVII, p.502.
- Schilling: Deut.med.Zeit., 1895, XVI, p.559.
- Schlesinger: Zeit.f.Klin.Med., 1892, XX, p.127.
- Schmidt: Dent.med.Woch., 1892, XVIII, p.585.
- Villani: Ref.med.Napoli, 1897, XIII, pp.795, 808, 818, 832.
- Berkeley: Med.News, N.Y., 1883, XLIII.
- Biondi: Boll.d.clin.Milan, 1897, XIV, p.385.
- Bondurant: Alienist and Neurol., St.Louis, 1896, XVII, p.247.
- Cirincione and Mirto: La psichiatria, la neuropatologia etc., 1890, VII, p.343; VIII, p.18.
- Clarke: Brain, 1897, XX, p.22.
- Collins: Bolin Med.and Surg.Jour., CXXXVII, p.657.
- Dillier: Amer.jour.Med.Sci., 1889, XCVIII, p.585.
- Dreves: Inaug.Diss.Gottingen, 1891.
- Duglison: Practice of Med., 1st.ed.1842, vol.II, p.312.
- Ewald: Zeit.f.Klin.Med., 1884, p.51, Suppl.to vol.VII.
- Geddes and Clinch: Jour.Ment.Sci., Lond., 1898, XLIV, p.811.
- Greppin: Arch.f.Psych., 1892, XXIV, p.155.
- Hriet: On Chronic Chorea.Paris.1889.
- Jolly: Neurol.Centralbl., 1891, X, p.321.
- Jordel: Contribution to the History of Chronic Chorea. Nancy, 1894.
- Kast: Dent.med.Woch., 1895, XXI, p.173.
- Kronthaland Kalischer: Neurol.Centralbl., 1892, XI, pp. 592, 631.
- Lannois and Paviot: Rev.med.Paris, 1898, XVIII, p.207.
- Solaro: Pediatria, Napoli, 1896, IV, p.169.
- Todd: Med.Times and Gaz., 1852, XXVI, p.79.
- Ollive: The paralysés of Chorea.These de Paris, 1884.
- Gompertz: Allg.med.Centr.Zeit., Berlin, 1896, LXV, p.85.
- Gineot: Gaz.Hebd.de med., 1887, XXIV, p.129.
- Albarel: Jour.de clin.et de therap.inf.Paris, 1897, V, p.803.
- Ball: Phila.N.J., 1898, I, p.299.
- Filaton: Arch.f.Kinderh.Stuttg.1894-95, XVIII, p.432.
- Rieder: Münich.med.Woch., 1889, p.623.
- De St.Florent: Congenital Chorea.Paris, 1896.
- Ballet: Bull.med.Paris, 1896, X, p.223.
- Brown Seqnard: Med.Times and Gaz, 1863, II, p.92.

- Gray: N.Y.Med.Jour., 1892, LVI, p.159.
Heller: Wien.med.Woch., 1876, XXVI, p.455.
Hirsch: Inaug.Diss.Leipzig, 1895.
Johnston: Amer.Jour.Med.Sci., 1895, CX, p.377.
Preston: N.Y.Med.Jour., 1896, LXIII, p.350.
Collins: Ibid., 1892, LVI, p.159.
Weiss: Allg.Wien.med Zeit., 1894, XXXIX, p.467.
Warner: Internat.Clin.Phila., 1897, I, p.208.
Dorland and Potts: Jour.Amer.Med.Assoc., Chicago, 1893, XXI, p.919.
Dresch: Bull.gen.de therap., 1890, CXVIII, p.337.
Dujardin-Beaumetz: Ibid., 1894, CXXVI, p.193.
Hubrecht: These de Paris, 1895.
Knapp: Boston Med.and Surg.Jour., 1895, CXXXII, p.304.
Loveland: Univ.Med.Mag., Phila., 1893-94, VI, p.605.
Mettenheimer: Arch.f.Kinderh.Stuttg., 1894, XVII, p.417.
Overend: Lancet, II, p.248.
Regnier: Arch.de neurol., 1895, XXIX, p.380.
Rockwell: Jour.Amer.Med.Assoc.Chicago, 1895, XXV, p.1092.
Sacca: Gaz.med.Lomb.Milan, 1898, LVII, p.197.
Zinn: Arch.f.Psych., 1896, XXVIII, p.411.
Arndt: Ibid., 1868-69, I, p.509.
Seglas: Bull.et mem.soc.med.de Hop., Paris, 1891, VIII, p.143.
Albert: Gaz.de Hop.Paris 1895, LXVIII, p.262.
McCann: Trans.Obstet.soc.Lond., 1891, XXXIII, pp.413, 416.
Arai: Ein Beit.z.Kenntnis Chorea gravidum, 1895.
Cameron: Montreal Med.Jour. 1895-6, XXIV, p.491.
Dakin: Practitioner, 1897, LIX, p.571.
Delage: Ann.de la polyclin.de Paris, 1898, VIII, p.121.
Fastenberg: Deut.med.Woch., 1897, XXIII, p.196.
Marce: The Mental Condition in Chorea. Paris, 1860.
Zinn: Arch.f.Psych., 1896, XXVIII, p.411.
Cesario-Demel: Gaz.med.de Torino, 1897, XLVII, pp.381, 601.
Donkin and Hebb: Med.Times and Gaz., 1884, II, p.743.
Jakowenko: Wiestnik psichiatr.i.nervopatol., 1889.
Patella: Gazz.d.ospital, 1888, IX, p.537.
Dereum: Text-book of Nervous Diseases, 1895.
Buist: Trans.Edin.Obstet.Soc., vol.XX.
Stewart, Purves: Clinical Considerations in Chorea. Edin Med.Jour., 1899.
Benton and Walker: Brit.Med.Jour., Jan.31, 1903.
Thomas, H.: Johns Hopkins Hosp.Bull., Oct., 1901.
Shaw: Albany Med.Ann., May, 1897.
Russel: Lancet, April 1, 1899.
Good, C.A.: Amer.Jour.of insanity, July, 1900.
Lundborg: Hygeia, 1900.
Murri: Arch.Ital.di Biol., 1901.
Fraenkel: Deut.Zeit.f.Nervenhe., April, 1899.
Krafft-Ebing: Wien.Klin.Woch., 1899.
Redlich: Centralbl.f.Allg.Path., Nov.4, 1894.
Gordiniar: Amer.Jour.Med.Sci., Dec., 1899.
Karplus: Jahr.f.Psych.u.Neurol., 1900.

Von Bechterew: Neurol.Centralbl.,Feb.,1900.
Jacoby: Jour.Nerv.and Ment.Dis.,July,1898.
Bernhardt: Allg.med.Centralz.,No.14,1899.
Dejerine and Sottas: Rev.Le Med.,March,1893.
Audibert: Arch.gen.de Med.,1902.
Crafts: Amer.Jour.Med.Sci.,June,1900.
Singer: Brain,1901.
Vargas: Ann.de Med.et Chir.Inf.,July 15,1904.
Somerville,W.F.: Electrol.and Radiol.,May,1904.
Tscherno-Schwarz: Arch.f.Kinderh.;Brit.med.Jour.,Aug.
15. 1903.
Chapman: Brooklyn Med.Jour.;Therap.Gaz.,July 15,1904.
Lees: Brit.Med.Jour.,Aug.29,1903.
Williamson: Lancet,Aug.22,1903.
Poynton,F.J.: Intern.Clin.,vol.II,13th Ser.
Mettler: Amer.Jour.Med.Sci.,Sept.,1903.
Burnet,Jas.: Brit.Jour.Ch.Dis.,April,1904.
Galdi: Il Policlin.,Nov.21,1903.
Marion,H.E.: Boston.Med.and Surg.Jour.,April 14,1904.
Fischer,T.: Brit.Med.Jour.,Aug.29,1903.
Aldrich,C.J.: Arch.of Pediat.,Nov.,1903.
Judson,C.F.: Ibid.,July,1903.
Zaoussalov: La Sem.med.,XXIV,No.9.
Schröder,H.: Fortschr.d.Med.,July,1903.
Stiles,C.W.: Editorial:Arch.of Pediat.,Dec.,1903.
Cohen,S.S.: Amer.Med.,Nov.28,1903.
Borri,A.: Gaz.degli Osped.,Sept.13,1903.
Edsall,L.: Annals of Gyn.and Pediat.,Mar.,1904.

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